

components such as IC chips to circuit boards can be provided with higher productivity and lower cost than those of the conventional bonding method.

As described above, the present invention is able 5 to eliminate the processes that have conventionally been needed for bonding an electronic component to a circuit board and remarkably improve the productivity.

When an insulating resin having no conductive particle (for example, a thermosetting resin sheet or a 10 thermosetting adhesive) is employed as a bonding material, there is no need for adding conductive particles into the insulating resin by comparison with the method described in connection with the second prior art. Therefore, an 15 inexpensive electronic component mounting method and apparatus can be provided.

The following effects can also be produced.

(1) Bump formation

According to the method of forming a bump with plating (third prior art), a special bump forming process 20 is required to be performed by the semiconductor manufacturer, and therefore, the bump formation can be formed only by the limited manufacturers. However, according to the present invention, IC chips for general-purpose wire bonding can be employed as an example of the 25 electronic component by means of a wire bonding device, and

IC chips can easily be available.

Moreover, the bump leveling for stabilizing the amount of transfer of the adhesive in an unstable transfer process of transfer such as the transfer of the conductive adhesive becomes unnecessary by comparison with the method of the first prior art, and the leveling device for such a leveling process becomes unnecessary.

If the approximately conically tipped bumps are formed on the electrodes of an electronic component, even when the bumps are mounted on the electrodes of the circuit board while being shifted, the bumps can partially come in contact with the electrodes of the board without fail so long as the shift is not greater than half the outside diameter of the bump since the bumps have the approximately conically tipped shape. According to the conventional bumps, the so-called bases of the bumps partially come in contact with the electrodes. However, this contact is mere partial contact, leading to unstable bonding. If this is subjected to a thermal shock test or reflow, the bonded portions become open. The present invention can eliminate the above-mentioned unstable bonding and provide the bonding of high production yield and high reliability.

(2) Bonding of IC chip to circuit board

According to the method of the second prior art, the connection resistance has been depended on the number

of conductive particles that exist between the bump and the electrode of the circuit board. However, according to the present invention, the bumps can be directly connected to the electrodes by being pressed against the electrodes of 5 the circuit board with a load (for example, a pressure force of not smaller than 20 gf per bump) heavier than in the first and second prior art examples without being leveled in the leveling process as an independent process. Therefore, the connection resistance value does not depend 10 on the number of interposed particles, and the connection resistance value can be stably obtained.

Although the conventional leveling process has been performed in order to shape the bump heights constant at the time of bonding to the board electrodes, the 15 crushing of the bumps can be performed concurrently with the bonding to the electrodes according to the present invention. Therefore, no independent leveling process is needed, and the bonding can be achieved while correcting the warp and undulation of the circuit board by deforming 20 the same, or the bonding is achieved while correcting the warp and undulation of the circuit board by deforming the same without the need for the leveling process of the bumps by hardening the conductive paste stuck to the bumps and deforming the conductive paste at the time of bonding. 25 Accordingly, this arrangement tolerates the warp and